III. REMARKS

In the Office Action, claims 1-6, 9-11, 13-17 and 19-21 were rejected under 35 U.S.C. 103 as being unpatentable over the admitted prior art in view of Heck (US 4,653,117), and claims 7, 8, 12 and 18 were rejected under 35 U.S.C. 103 as being unpatentable over the admitted prior art in view of Heck (US 4,653,117) and Rapeli (US 6,510,313) for reasons set forth in the Action.

The following argument is presented to show that the present claims, including the amended claims, recite subject matter that is not taught by the cited art, thereby to overcome the foregoing grounds of rejection and to indicate the presence of allowable subject matter in the claims.

The claims recite a local oscillator frequency, which is equal to or about a carrier frequency plus an offset frequency with the offset frequency being equal to or about the difference between the carrier frequency and a null frequency. The null frequency is centered at a notch of a sideband.

With respect to the spectrum of the modulated received signal, the independent claims state that the notches are at null points located on a frequency axis at multiples of a chip rate from the carrier frequency. Certain ones of the independent claims that did not previously recite this characterization of the spectral null points have been amended to provide this additional description for defining over the combined teachings of the cited art, particularly the teachings of Heck, in view of an interview conducted with the examiner.

An interview was conducted by telephone between David Warren and Examiner Alexander Jamal on September 27, 2006. There was discussion of the examiner's reasoning in rejection of the claims, the teaching of the Heck reference, portions of the present specification discussing signal nulls, and proposed amendatory language

providing further definition of the spectral nulls of the signal being processed by the direct-conversion process.

The examiner expressed the opinion that the portion of the Heck patent (col. 6 at line 64 to col. 7 at line 30), cited in the Office Action, teaches the principle that one can offset the mixing frequency from the value of the carrier frequency by an amount sufficient to be in a portion of the signal wherein, in the opinion of the examiner, there is no spectral content, which portion of the signal is considered by the examiner to be a null. The examiner further opined that the claim language is sufficiently broad so as to read on the Heck teaching of the null.

It is noted that the use of the term "null" only appears in the Examiner's comments in Office Action on page 3 at line 8. The term "null" does not appear anywhere in the text of the Heck patent. This comment by the examiner in the Office Action is understood to mean that the examiner believes that the teaching of Heck somehow anticipates or suggests the term "null", as it appears and is used in the present claims. This interpretation is respectfully traversed. Also, with respect to the above-noted Examiner's statement in the Office Action, at the interview between the Examiner and David Warren, it is noted that there is no language or disclosure in Heck related to an offsetting of a mixing frequency by an amount sufficient to be in a portion of the signal where there is no spectral content. This language is not found in the Heck patent, and is understood to be only the examiner's interpretation of Heck.

Further, in the interview, it was pointed out to the Examiner that the specification was very specific in just what was meant by a null in the signal being applied to the down-conversion circuitry. The specification teaches that the signal has a spectral characteristic of a plurality of lobes separated by notches, the notches being at null points located on a frequency axis at multiples of a chip rate from the carrier frequency. By way of example, on page 5 at lines 14-17, the present specification teaches that the chip rate is the inverse of the bit duration time. It was emphasized to the examiner that

this specific teaching, which is important in the practice of the present invention, is not disclosed anywhere in Heck. Thus, a combination of Heck with the other cited art would not teach or suggest the foregoing features as claimed by Applicant.

The Examiner acknowledged that it might be advantageous to define "null" in a manner that clearly distinguishes the "null" of the present claims from Heck. No commitment was made by the Examiner that such a definition in the claims would be sufficient to secure allowance of the claims. After discussion, the Examiner also noted that Heck treats only an analog system, and says nothing about a digitized sampled system that is characterized by the sequence of spectral lobes separated by spectral nulls, as is recited by Applicant in the claims. This understanding should aid in distinguishing the teaching of Heck from the teaching of the present specification and claims.

The following two paragraphs of Heck (col. 6 at line 64 to col. 7 at line 30), cited by the examiner in the Office Action, are of particular interest.

Heck states:

FIG. 4 illustrates an embodiment 10", constructed in accordance with the invention, which includes alternative means for controlling the down-conversion oscillator frequency. Instead of being converted to exactly zero frequency, the translated input signal is provided with a small offset from zero. The purpose of the frequency offset is to avoid the problems of DC offsets yet retain the precise frequency control and inherent demodulation capabilities of the phase lock loop, as in the receiver of FIG. 1. The two input signals to phase detector 90 are now the output signal from limiter 80 and a reference frequency 52 from oscillator 51. Reference 52 differs from up-conversion frequency 37 by a frequency lower than the modulation frequencies to be received. The phase lock loop locks with the output of limiter 80 equal to the frequency of reference oscillator 51. For this to occur, the translated carrier frequency of the signals in the baseband paths of translating filter 30 must equal the difference between frequencies 37 and 52. This occurs when VCO 40 differs from input 31 by the same

offset amount. This offset frequency may be set on the order of 10 to 100 Hz. It should be noted that there will be an image response, that is, that input 31 may be offset above or below the VCO. However, the separation between images will be much less than the channel spacings, and no interfering signals should be present.

Heck states further:
Because an unmodulated carrier at 31 produces no DC signals in the baseband paths, DC coupling and the need to maintain low offsets may be avoided. Any beat note that may arise because of imperfect matching will be below the lowest modulation frequency and may be blocked from the demodulated output signal by high-pass coupling techniques.

By way of further argument with respect to the Heck patent, in the aforementioned extract from Heck (col. 6 at line 64 to col. 7 at line 30) cited by the Examiner, Heck teaches a small offset (column 7 at line 1) by a magnitude of frequency lower than a received modulation frequency (col. 7 at line 9) on the order of 10 to 100 Hertz (col. 7 at line 17). This is much smaller, by orders of magnitude, than a chip rate recited in the claims. With respect to the above-noted definition of the chip rate in the present specification (page 5 at line 15), wherein the chip rate is said to be the inverse of the bit duration time, this would give a chip rate of approximately a megahertz in a GPS system, by way of example (page 4 at line 32 in the specification). Also, Heck makes reference (col. 1 at line 45) to the Weaver method (US patent 2,928,055), which antedates present digital technology, and does not discuss any of the present-day digital signal-processing technology with its associated spectra. In contrast, the present specification (page 1, beginning at line 7) deals with digital signal processing.

Heck does not disclose a baseband independent "null" for his analog signal. The only "null" that could be present would be due to a null present in the spectrum of the baseband signal that was analog modulated. But such a "null" would be baseband signal dependent and not system dependent. This is different than the present

application where the chip rate is chosen for the system and is not baseband signal dependent. A system dependent null such as in the present application is the same for any baseband signal processed by the system. The chip rate comes about by virtue of the system sampling rate, and is the same even though various baseband signals processed by the system may differ from each other. The chip rate sets the location of the null on the frequency axis.

In the foregoing extract from Heck, it is noted that the purpose of the frequency offset is to avoid the problems of DC offsets yet retain the precise frequency control and inherent demodulation capabilities of the phase lock loop, as in the receiver of FIG. 1. Further, the phase locked loop deals with the output of a limiter. Also, the offset frequency may be set on the order of 10 to 100 Hz.

What Heck says, in the foregoing extract, is that the offset should be on the order or 10-100 Hz. Heck does not teach one to choose an offset with respect to any "null" or where there is "no spectral content". Note that Fig. 4 of Heck also shows a system that includes the demodulator. The output is shown as the "demodulated audio 110". If the offset were larger than his suggested range, there would be demodulation problems, etc. and the recovered signal would be corrupted. Heck specifically states this when he says "yet retain the precise frequency control and inherent demodulation capabilities of the phase lock loop, as in the receiver of FIG. 1". Heck does not say that the 10-100 Hz offset is where there is a null, but teaches that the information lost in the demodulation process would be minimal and the receiver would still function properly.

In summary, Heck's suggested offset of 10-100 Hz is two-fold: (1) there is little information in the baseband signal in this range and (2) if the offset is that small, the demodulated audio signal will still be good. If the offset was as large as that in the present application (set by the chip rate), the system described in Heck would not work – the demodulated signal would be corrupted.

If one considers, for example, an FM receiver with an analog tuning dial, and slightly detunes a signal, one can still hear the demodulated signal adequately. If the detuning is too far, the output will become garbled. This amounts to setting an offset between the carrier and the local oscillator in the receiver. If the same experiment is tried with an FM radio with a synthesizer, each frequency tuning jump is 200 KHz. (This is the channel spacing in the US FM band.) A 200 KHz jump will make the recovered audio garbled (one may try this where there is no adjacent channel signal). The channel spacing in a receiver such as described in Heck would probably be about 10 KHz (voice channel), so an offset as large as the one that would be used in the present application (set by a chip rate) would render the Heck receiver inoperable.

It is apparent from the description of the operation of the Heck circuitry that there is some signal in the region of DC, and that Heck filters it out. In contrast, with respect to the signal processed by the present invention, the signal is absent in the spectral nulls by virtue of the sampling of the signal. Therefore, the teaching of the present specification deals with a true null, while Heck does not deal with a true null.

In view of the foregoing argument, it is urged that the present claims distinguish over the teachings of Heck, considered alone and in combination with the other references, so as to overcome the foregoing rejections and to present allowable subject matter in the claims.

For all of the foregoing reasons, it is respectfully submitted that all of the claims now present in the application are clearly novel and patentable over the prior art of record, and are in proper form for allowance. Accordingly, favorable reconsideration and allowance is respectfully requested. Should any unresolved issues remain, the Examiner is invited to call Applicants' attorney at the telephone number indicated below.

The Commissioner is hereby authorized to charge payment for any fees associated with this communication or credit any over payment to Deposit Account No. 16-1350.

Respectfully submitted,

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